

Solid State MEMS Thrusters Using Electrically Controlled Extinguishable Solid Propellant, Phase I

Completed Technology Project (2005 - 2005)



Project Introduction

ET Materials, LLC developed the first ever electrically controlled extinguishable solid propellant (ECESP). The original propellant developed under Air Force SBIR contracts became known as ASPEN. The start/stop capabilities were first demonstrated in end burning configurations that operated by feeding the propellant against stationary electrodes. Continuing research by ET Materials led to a new family of ECESP propellants prepared as solution solid propellants. These propellants provided higher performance than the ASPEN, but are more electrically conductive. This feature was not as desirable as first thought because the electrode gap has to be much narrower to cause the propellant to ignite at the surface, which makes it more difficult to scale for larger motors. The high conductance of the propellant makes it ideal for a MEMS application as the propellant can be cast in thin layers. Since the propellant will only sustain combustion when electrical power is supplied stacked layers of the propellant could be ignited separately without causing ignition of neighboring layer. This provides more versatility than similar MEMS designs utilizing conventional solid propellants. In the Phase I study "micro cluster thrusters" will be fabricated and tested under vacuum conditions to establish the power and controller requirements.

Anticipated Benefits

The electrode design proposed in this program is very compatible with standard semiconductor (layered) manufacturing. Thus, microactuators operating from on demand gas generation could lead to a new class of pneumatically powered nano-robotic devices. NASA would be able to implement this technology for any of their missions utilizing small spacecraft for forming satellite or spacecraft constellations. The small size and simplicity would allow their use in the extended boons of an atypical spacecraft. The technology, also, is very attractive for larger satellites requiring refueling such as DARPA's Orbital Express Program.



Solid State MEMS Thrusters
Using Electrically Controlled
Extinguishable Solid Propellant,
Phase I

Table of Contents

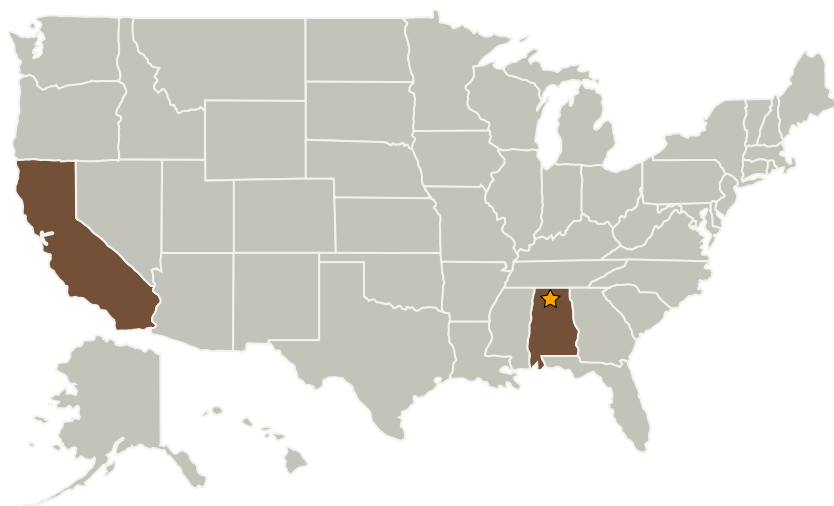
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Areas	2

Solid State MEMS Thrusters Using Electrically Controlled Extinguishable Solid Propellant, Phase I

Completed Technology Project (2005 - 2005)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
ET Materials, LLC	Supporting Organization	Industry	Rancho Cordova, California

Primary U.S. Work Locations	
Alabama	California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Chris Protz

Principal Investigator:

Charles Grix

Technology Areas

Primary:

- TX01 Propulsion Systems
 - ↳ TX01.1 Chemical Space Propulsion
 - ↳ TX01.1.1 Integrated Systems and Ancillary Technologies